

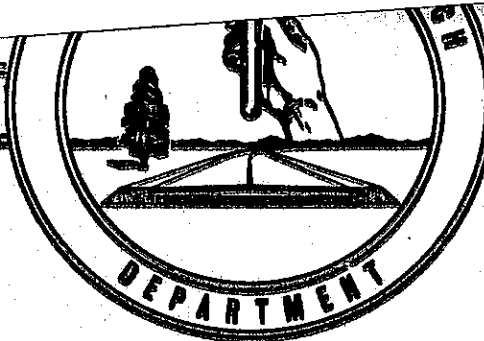
STATE OF CALIFORNIA
HIGHWAY TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS



SUPPLEMENTAL INFORMATION ON
DRYING SHRINKAGE OF MODEL CONCRETE
BEAMS EXPOSED OUTSIDE

(INCLUDING THE EFFECT OF A CHEMICAL ADMIXTURE)

65-14
DND



State of California
Highway Transportation Agency
Department of Public Works

MATERIALS AND RESEARCH DEPARTMENT

August, 1965

PWO 5046 R

Mr. L. R. Gillis
Assistant State Highway Engineer
California Division of Highways
Sacramento, California

Dear Mr. Gillis:

Submitted for your consideration is supplemental
information on;

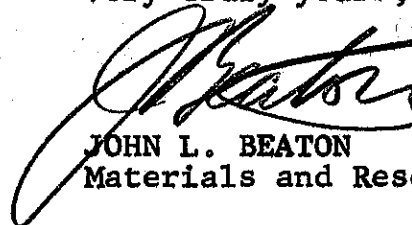
Drying Shrinkage of Model Concrete

Beams Exposed Outside

(including the effect of a chemical admixture)

Study made by	Concrete Section
Under direction of	D. L. Spellman
Work supervised by	J. H. Woodstrom
Report prepared by	F. E. Kinsman

Very truly yours,



JOHN L. BEATON
Materials and Research Engineer

cc: JEMcMahon
JFJorgensen
WHAmes
JHWoodstrom
FEKinsman

WILLIAM H. WOODWARD

1900-1901

1902-1903

Incumbent for the year 1900-1901

of the Board of Directors

James E. Wood

(On the 1st of January 1901)

General Session
J. E. Wood
J. E. Wood
J. E. Wood

Very truly yours

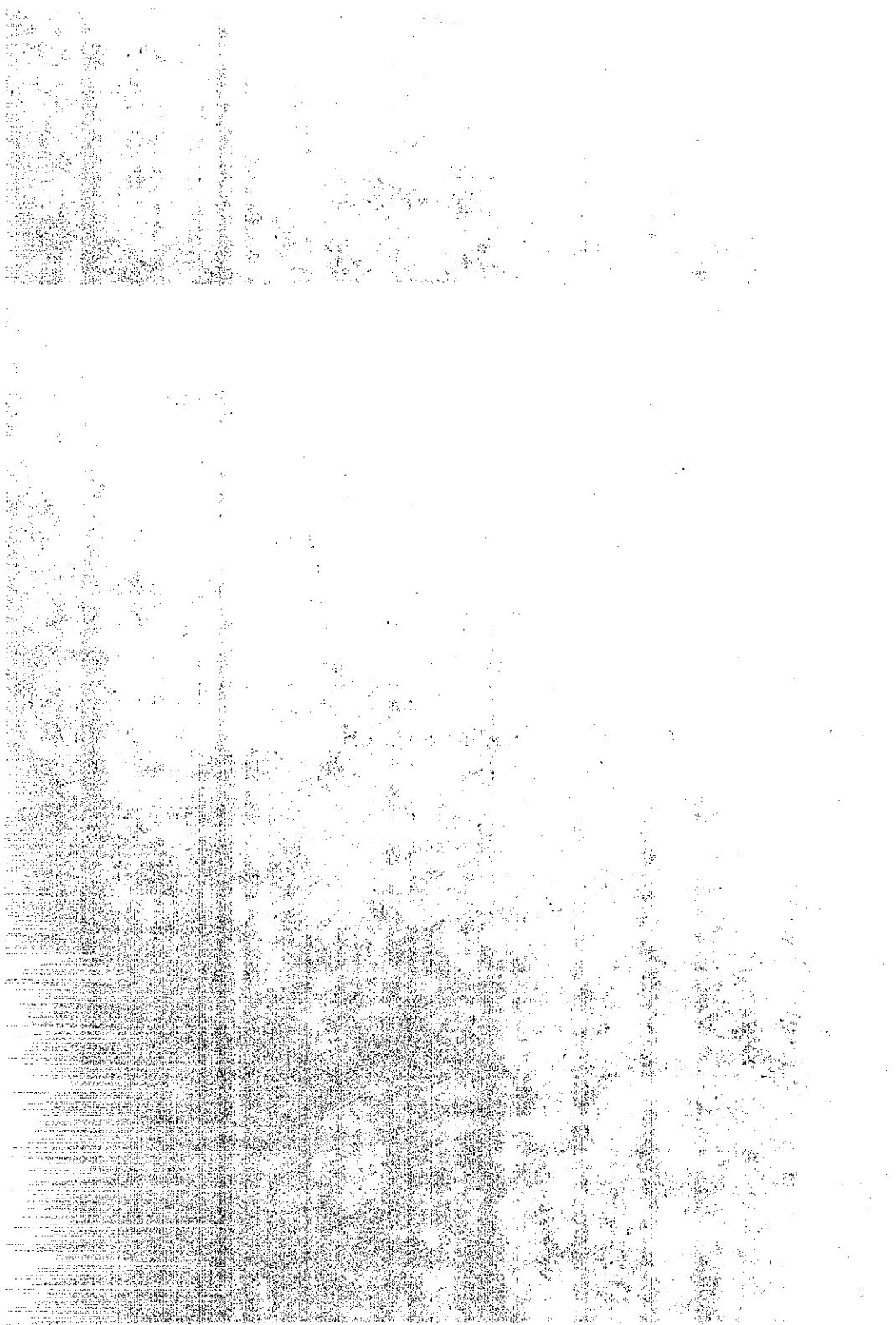
JOHN E. WOOD

President of the Board of Directors

1900-1901
1901-1902
1902-1903
1903-1904
1904-1905

Table of Contents

	Page
Introduction	1
General	2
Conclusions	3
Graph	Shrinkage of Beams and 4x5x18-inch Bars



Supplemental Information on
DRYING SHRINKAGE OF MODEL CONCRETE
BEAMS EXPOSED OUTSIDE
(Including the effect of a chemical admixture)

Introduction

The original report for this project was submitted by Mr. F. N. Hveem in December, 1961, under Laboratory Authorization No. 5046 R 46, and represented data obtained over a 70-week period. Length measurements made at the cessation of the initial 7-day moist curing period were the values used as initial measurements. Subsequent measurements were made after 7, 14 and 28 days of exposure, and thereafter at intervals of 28 days. To possibly obtain additional information, measurements were continued after the 70-week period on a bi-yearly basis with readings made at the beginning and end of each drying season (May and October). Measurements were terminated in May 1965, making a total of 248 weeks of exposure since the inception of the project.

General

Measurements obtained on the beams and bars subjected to outside exposure since the 1961 report was published, indicated drying shrinkage and expansion was cyclic in nature with the alternate wetting and drying seasons. There was a slight continual increase in shrinkage up to the termination of the study. Shrinkage bars subjected to laboratory drying showed a slight gradual increase in shrinkage up to the termination of the measurements.

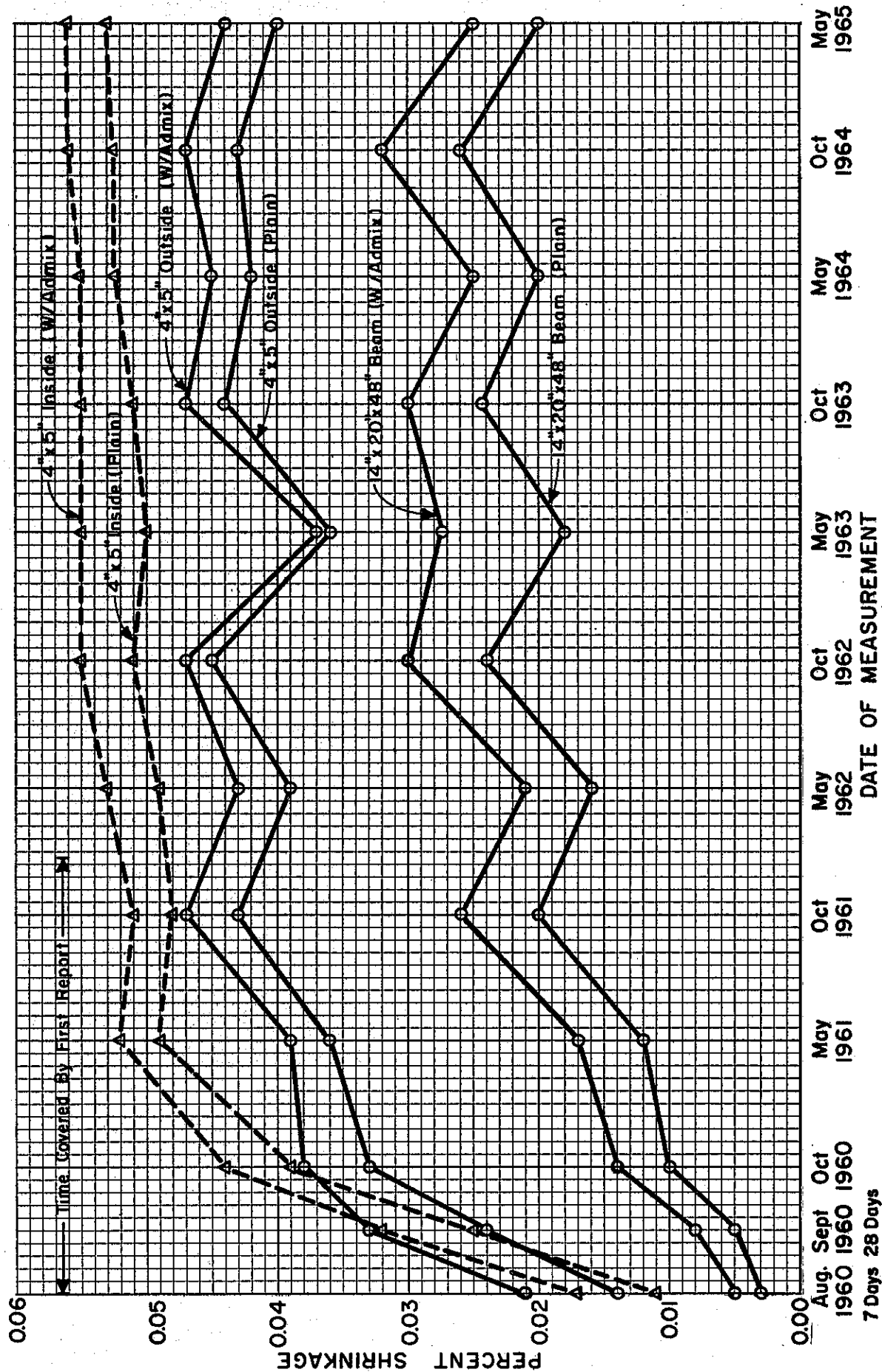
A graph showing the 7 and 28-day measurements with subsequent May and October measurements of the full size beams and 4x5x18-inch bars is included to demonstrate the cycling of shrinkage and expansion with the seasons.

1. The first of these is the fact that the
2. second is the fact that the
3. third is the fact that the
4. fourth is the fact that the
5. fifth is the fact that the
6. sixth is the fact that the
7. seventh is the fact that the
8. eighth is the fact that the
9. ninth is the fact that the
10. tenth is the fact that the
11. eleventh is the fact that the
12. twelfth is the fact that the
13. thirteenth is the fact that the
14. fourteenth is the fact that the
15. fifteenth is the fact that the
16. sixteenth is the fact that the
17. seventeenth is the fact that the
18. eighteenth is the fact that the
19. nineteenth is the fact that the
20. twentieth is the fact that the
21. twenty-first is the fact that the
22. twenty-second is the fact that the
23. twenty-third is the fact that the
24. twenty-fourth is the fact that the
25. twenty-fifth is the fact that the
26. twenty-sixth is the fact that the
27. twenty-seventh is the fact that the
28. twenty-eighth is the fact that the
29. twenty-ninth is the fact that the
30. thirtieth is the fact that the
31. thirty-first is the fact that the
32. thirty-second is the fact that the
33. thirty-third is the fact that the
34. thirty-fourth is the fact that the
35. thirty-fifth is the fact that the
36. thirty-sixth is the fact that the
37. thirty-seventh is the fact that the
38. thirty-eighth is the fact that the
39. thirty-ninth is the fact that the
40. fortieth is the fact that the
41. forty-first is the fact that the
42. forty-second is the fact that the
43. forty-third is the fact that the
44. forty-fourth is the fact that the
45. forty-fifth is the fact that the
46. forty-sixth is the fact that the
47. forty-seventh is the fact that the
48. forty-eighth is the fact that the
49. forty-ninth is the fact that the
50. fiftieth is the fact that the
51. fifty-first is the fact that the
52. fifty-second is the fact that the
53. fifty-third is the fact that the
54. fifty-fourth is the fact that the
55. fifty-fifth is the fact that the
56. fifty-sixth is the fact that the
57. fifty-seventh is the fact that the
58. fifty-eighth is the fact that the
59. fifty-ninth is the fact that the
60. sixtieth is the fact that the
61. sixty-first is the fact that the
62. sixty-second is the fact that the
63. sixty-third is the fact that the
64. sixty-fourth is the fact that the
65. sixty-fifth is the fact that the
66. sixty-sixth is the fact that the
67. sixty-seventh is the fact that the
68. sixty-eighth is the fact that the
69. sixty-ninth is the fact that the
70. seventieth is the fact that the
71. seventy-first is the fact that the
72. seventy-second is the fact that the
73. seventy-third is the fact that the
74. seventy-fourth is the fact that the
75. seventy-fifth is the fact that the
76. seventy-sixth is the fact that the
77. seventy-seventh is the fact that the
78. seventy-eighth is the fact that the
79. seventy-ninth is the fact that the
80. eightieth is the fact that the
81. eighty-first is the fact that the
82. eighty-second is the fact that the
83. eighty-third is the fact that the
84. eighty-fourth is the fact that the
85. eighty-fifth is the fact that the
86. eighty-sixth is the fact that the
87. eighty-seventh is the fact that the
88. eighty-eighth is the fact that the
89. eighty-ninth is the fact that the
90. ninetieth is the fact that the
91. ninety-first is the fact that the
92. ninety-second is the fact that the
93. ninety-third is the fact that the
94. ninety-fourth is the fact that the
95. ninety-fifth is the fact that the
96. ninety-sixth is the fact that the
97. ninety-seventh is the fact that the
98. ninety-eighth is the fact that the
99. ninety-ninth is the fact that the
100. hundredth is the fact that the

*

Conclusions

Measurements made over the extended period did not indicate anything that would alter the conclusions made in the 1961 report. It had been concluded that laboratory drying shrinkage tests of customary size test specimens should be discontinued at relatively short ages. This was based on the fact that the rate at which concrete specimens lose moisture and shorten during drying is proportional to the ratio of exposed surface to volume. Under outside exposure in a climate similar to the Sacramento Valley, the length of the summer season in any year is too short to accomplish full drying and shortening of large members. Measurements indicated that shrinkage in a controlled temperature and humidity for 14 days (for 3x3x10-inch test specimens) equalled the maximum attained for the full size beams outside over the longer summer exposure period. For the 4x5x18-inch specimens, 21 to 28 days of drying under controlled laboratory conditions equalled that of the full size members outside. It was also concluded that the test for the effect of chemical admixtures on drying shrinkage of concrete performed in accordance with Test Method No. Calif. 530-A provided a reliable measure of the performance of admixtures in concrete subjected to exterior exposure.



SHRINKAGE OF BEAMS AND 4"x5"x18" BARS
CONCRETE, PLAIN AND WITH ADMIXTURE

